ROAD SAFETY AUDIT REVIEWS SDDOT CUSTER AREA OCTOBER 15-17, 2002

SD 89 - from US 16A to Sylvan Lake (MP 58.5 – 64.6).
SD 87 - from US 16A North to the Black Hills Playhouse (MP 59.5 – 62.0).
SD 87 - from US 16 South to Sylvan Lake (MP 73 -79).
US 16A - thru Custer State Park (MP 28 -39).
US 16A - thru Iron Mounain Road (MP 39 – 55.7).

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SD 89 from US 16A to Sylvan Lake (MP 58.5 – 64.6).

The functional class of this road is Rural Minor Arterial. The road has a posted speed limit of 45 MPH and the surface is asphalt concrete. For the purpose of the audit the location information is referenced from the south end of the section (MP 58.5) increasing by miles heading north.

The following are the findings and recommendations of the RSAR team:

NOTE: The design criteria used to determine minimum design standards for lane width, shoulder width, clear zone, and inslope are 3R standards from SDDOT Policy RD-1998-02. They are as follows: lane width 10 ft., shoulder width 2 ft, clear zone 10 ft., & inslope 3:1.

The following items were identified as areas where immediate safety improvements should be made:

- Check road with ball bank indicator upgrade advisory speed plates accordingly.
- ADD 8 inch edge line to enhance identification of roadway edge.
- MP 58.5 Rt. Move "Adopt-A-Highway" sign farther from roadway.
- MP 58.5 Rt. "Large Vehicle" sign Increase size of sign put tunnel clearance with dimensions on top as fluorescent black/yellow diamond grade move closer to roadway. (NOTE: The tunnel sign on SD 87 is yellow/black. To establish consistency in this type of signing, this sign should also be yellow/black).
- MP 58.5 "Two way" sign is mounted too low.
- MP 58.6 Add "Right Lane Must Turn Right" sign for right turn lane.

- MP 58.7+ Lt. Add "Curve" sign for southbound traffic.
- Willow Creek Rd. Remove trees on the south side of intersection to improve sight triangle.
- Montgomery St. Remove trees on the south side to improve sight triangle.
- MP 59.9 RT. Replace "Winding Road" sign.
- MP 60.50 Lt. Replace "Winding Road" sign.
- MP 60.55 Lt. Replace "Deer Crossing" sign.
- MP 60.9 Rt. "Curve" sign is missing.
- MP 61.2 Rt. Add "Type II Object Marker" on pipe.
- MP 61.3 Lt. Replace "Winding Road" sign.
- MP 61.35 Rt. & Lt. Replace "Bump Marker" with "Type II Object Marker" on pipe.
- MP 61.45 61.50 Lt. Remove trees & rock on outside of curve.
- MP 61.60 Lt. Remove trees.
- MP 61.7 Lt. Remove power pole and anchor from ditch
- MP 61.7+ Lt. Replace "45 MPH" sign.
- MP 61.9 Rt. & Lt. Install "Type II Object Marker" on pipe.
- MP 62.2 Rt. "Curve" sign missing check distance from curve.
- MP 62.2 Rt. Remove rock.
- MP 62.35 62.45 Lt. Remove small rock in ditch.
- MP 62.4 Lt. "Winding Road" sign missing.
- MP 62.5 Lt. Install "Type II Object Markers" along creek
- MP 62.6 Rt. & Lt. Add "Type II Object Markers" on pipe.
- MP 62.65 Rt. & Lt. Add "Type II Object Markers" on pipe.
- MP 62.65 Add "Type II Object Markers" along creek.
- MP 62.0 63.0 Lt. Remove rock; Rt. Flatten the backslope.
- MP 63.20 .40 Lt. Install "Type II Object Markers" on trees to mark drop off.
- MP 63.4 Rt. Remove rock.
- MP 63.5 Lt. Install "Type II Object Markers".
- MP 63.5 Rt. & Lt. Install "Type II Object Marker" on pipe.
- MP 64.3 Rt. Remove rock.
- MP 64.40 .50 Lt. Remove trees within clear zone.

NOTE: Instead of installing type II object markers along the severe drop off areas, vertical panels could be installed about every one-tenth mile with emphasis on placing them at the beginning of the severe drop off. Also, consider installing "Shoulder Drop Off" signs with "XX Miles" plaques at beginning of this section and at increments through the section.

The following items were identified as areas where low cost improvements could have a positive impact on safety and should be considered in a reasonable period of time:

- MP 58.7 Rt. Hall Dr. extend asphalt to end of radius.
- MP 59.3 Rt. Daylight rock pile snag.
- MP 59.5 Lt. Lay back backslope to improve sight triangle.

- MP 60.1 Rt. Remove rock to clear zone.
- MP 60.2 Rt. Lay back the backslope for a longitudinal distance of about 100 Ft.
- MP 60.35 Lt. Remove rock from clear zone.
- MP 60.65 Lt. Reshape inslope on inside of curve.
- MP 62.5 Lt. Fill in inslope along creek use dirt from Rt. Side.
- MP 63.4 Lt. Raise approach to meet roadway.

The following items were identified as high cost improvements that should be considered as funds become available for a major rehabilitation or reconstruction of the roadway:

- Montgomery St. raise grade line to match SD 89.
- Inslope flattening along project.
- MP 60.3 Rt. & Lt. Lay back backslope for 200 + or Ft. (longitudinal distance).
- MP 60.45 Rt. Lay back backslope.
- MP 60.9 61.1 Rt. Lay back backslope.
- MP 61.8 Lt. Realign channel on left and provide adequate inslope.
- MP 61.8 62.0 RT. Lay back backslope to improve sight distance.
- MP 62.15 Lay back backslope to improve sight distance.
- MP 62.45 Rt. Remove rock to improve sight distance.
- MP 62.65 62.7 Rt. Lay back backslope.
- MP 62.75 Rt. Lay back backslope.
- MP 62. 85 Rt. Lay back backslope.
- MP 63.0 .70 Rt. Lay back backslope.
- MP 64.1 Rt. Lay back backslope.

GENERAL NOTES:

Mailboxes: Work with mailbox owners to upgrade mailbox supports to meet breakaway standards.

There are severe shoulder drop off alone asphalt through out project. Some range from 6-24 inches. It may take inslope repair to stabilize asphalt edge.

Slope flattening on approaches could be done in conjunction with resurfacing.

If this section was to be reconstructed, it would probably be done with about a 30 MPH design speed and probably follow the existing centerline. With this design, the project would gain some shoulder width and inslope improvements.

SD 87 from US 16A North to the Black Hills Playhouse (MP 59.5 – 62.0).

The functional class of this road is Rural Minor Arterial. The road is posted with a 35 MPH speed limit and is surfaced with asphalt concrete. For the purpose of the audit, the location

information is referenced from the north end of the section (MP 62.5) decreasing by miles heading south.

The following are the finding and recommendations of the RSAR team:

NOTE: The design criteria used to determine minimum design standards for lane width, shoulder width, clear zone, and inslope are 3R standards from SDDOT Policy RD-1998-02. They are as follows: lane width 10 ft., shoulder width 2 ft, clear zone 10 ft., & inslope 3:1.

The following items were identified as areas where immediate safety improvements should be made:

- MP 62.3 Lt. Install "Type II Object Marker" at pipe end.
- MP 62.28 Lt. Install "10 MPH" plaque on "Winding Road" sign and remove "Sharp Curve" sign both northbound and southbound.
- MP 62. 21 Rt. & Lt. Install "Type II Object Marker" on pipe.
- MP 62.1 .07 LT. Install "Type II Object Marker" on drop off.
- MP 61.46 Lt. & Rt. Install "Type II Object Marker" on pipe.
- MP 60.92 Rt. Install "Type II Object Marker" on pipe.
- MP 60.65 Lt. Consider laying back vertical backslope (short longitudinal distance).
- MP 60.36 Lt. & Rt. Bump markers located on end of Pipe. Should they be object markers? Does this pipe develop bump with frost cycle?
- MP 60.3 & 62.25 Lt. & Rt. Install "Type II Object Marker" on pipe.
- MP 61.12 Rt. Remove trees in clear zone.
- MP 60.05 Lt. Remove tree.
- MP 60.05 Lt. Install "Type II Object Marker" on drop off.
- MP 59.76 Rt. Remove tree
- MP 59.71 Lt. "Curve" sign hidden by trees.
- MP 59.86 Lt. & Rt. Clear trees on backslope.
- MP 59.58 .86 Rt. Clear trees on backslope.
- MP 59.54 Lt. & RT. Install "Type II Object Marker" on pipe.

NOTE: Conduct inspection of signing for reflectivity, lateral offset, and mounting height. Upgrade accordingly.

The following items were identified as areas where low cost improvements could have a positive impact on safety and should be considered in a reasonable period of time:

• MP 59.84 Lt. - Lay back backslope – small area.

The following items were identified as high cost improvements that should be considered as funds become available for a major rehabilitation or reconstruction of the roadway:

• MP 62. 2 - Several Sharp curves with rock close to roadway – lay back backslope (In area near Playhouse driveway).

• MP 59.9 Rt. - Lay back backslope.

SD 87 from US 16 South to Sylvan Lake (MP 73 -79).

The functional class of this road is Rural Minor Arterial. The road has a posted speed limit of 35 & 45 MPH and is surfaced with asphalt concrete. For the purpose of the audit the location information is referenced from the South end of the section (MP 73.4) increasing by miles heading north. The following are the finding and recommendations of the RSAR team:

NOTE: The design criteria used to determine minimum design standards for lane width, shoulder width, clear zone, and inslope are 3R standards from SDDOT Policy RD-1998-02. They are as follows: lane width 10 ft., shoulder width 2 ft, clear zone 10 ft., & inslope 3:1.

The following items were identified as areas where immediate safety improvements should be made:

Note: Run the route with a ball bank indicator to check speed plates on curve signs. Consideration should be given to posting the regulatory speed based on ball bank results.

- MP 73.6 Rt. Remove rock.
- MP 73.75 Rt. Lay back backslope and create shallow drainage ditch.
- MP 73.8 Rt. & Lt. Install "Type II Object Marker" on pipe.
- MP 73.8 Rt. Tunnel sign "Large Vehicle" sign Increase size of sign put tunnel clearance with dimensions on top as fluorescent black/yellow diamond grade move closer to roadway.
- MP 73.85 Rt. Install "Type II Object Marker" on pipe.
- MP 73.9 Slyvan Lake Resort Rd. Remove trees to improve sight triangle.
- MP 74.2 Rt. Remove trees in clear zone.
- MP 74.3 Rt. & Lt. Remove trees in clear zone.
- MP 74.4 Rt. Install "Type II Object Marker".
- MP 74.45 Rt. Install "Type II Object Marker".
- MP 74.5 Rt. Replace "Winding Road" sign and move farther south.
- MP 74.6 Rt. Replace "Tunnel Warning" sign (B/Y) increase size of legend and move farther from tunnel. Add a "One Lane Road Ahead" in advance of tunnel.
- MP 74.7 Lt. Replace "Tunnel Warning" sign (B/Y) Increase legend size move farther from tunnel. Add a "One Lane Road Ahead" sign in advance of tunnel.
- MP 74.8 (switch back) Fill drop off on asphalt edge on inside of curve. Water is washing away the gravel.
- MP 74.9 (switchback) Roadway is 15-20 ft wide no striping in this area. Recommend widening roadway to normal width.
- MP 75.0 (switch back) Fill drop off on asphalt on inside of curve. Water is washing away the gravel. Consider the installation of a down spout in these two curves to prevent erosion.

- MP 75.1 Culvert marker is laying down.
- MP 76.3 Rt. Driveway Clear trees to increase sight triangle.
- MP 76.55 Rt. "Curve" sign needs speed plate.
- MP 76.7 Lt. Driveway Clear trees to the south to improve sight triangle.
- MP 77.5 Rt. Power pole in clear zone Add "Type II Object Marker" to power pole. It would be best to see if the power company could move the pole.
- MP 77.6 Rt. "SD 87 Route Marker" with "Diagonal Arrow" should be moved so it is read prior to the intersection for northbound traffic. Add dashed edge line around the outside of the curve to help define highway from the "Y" type approach.
- 77.75 Rt. Co. Rd. T357 (Palmer Creek Rd) remove tree from center of approach.
- 77.8 Rt. Replace 'Right Reverse Turn" sign & "Advisory Speed" plate.
- 77.9 Rt. Remove trees on the backslope.
- 77.8 Rt. Replace "Large Arrow".
- 77.9 Rt. Replace "Large Arrow".
- 78.05 Rt. Add "Type II Object Marker" on pipe.
- 78.1 Lt. Replace "Reverse Turn" sign and "Advisory Speed" plate.
- 78.1 Rt. Replace "Reverse Curve" sign and "Advisory Speed" plate
- 78.15 Rt. Add "Type II Object Marker" on pipe.
- 78.25 Rt. Add "Type II Object Marker" on pipe.
- 78.40 Lt.- Replace "Reverse Curve" sign.
- 78.6 Lt. Raise approach to match grade line with roadway.
- 78.65 Rt. Remove rock.
- 78.7 Lt. & Rt. Replace "Curve" signs.
- 78.75 Rt.- Remove rock.
- 78.75 Rt. Add "Type II Object Marker".
- 78.8 Rt. Add "Type II Object Marker".
- 78.85 Rt. Add "Type II Object Marker".
- 78.9 Lt. Replace "Curve" sign.
- 78.95 Rt. Replace "Winding Road" sign.
- Revise intersection signing at SD 87 & US 16 as per MUTCD.

The following items were identified as areas where low cost improvements could have a positive impact on safety and should be considered in a reasonable period of time:

None

The following items were identified as high cost improvements that should be considered as funds become available for a major rehabilitation or reconstruction of the roadway:

- MP 73.9 LT. Lay back backslope
- MP 74.1 Lt. Lay back backslope.
- MP 77.9 Rt. Lay back backslope to improve sight distance.

US 16A thru Custer State Park (MP 28 -39).

The functional class of this road is Rural Minor Arterial. The road has a posted speed limit of 35 MPH and is surfaced with asphalt concrete. For the purpose of the audit the location information is referenced from the west end of the section (MP 28.00) increasing by miles heading east.

The following are the findings and recommendations of the RSAR team:

NOTE: The design criteria used to determine minimum design standards for lane width, shoulder width, clear zone, and inslope are 3R standards from SDDOT Policy RD-1998-02. They are as follows: lane width 10 ft., shoulder width 2 ft, clear zone 15 ft., & inslope 3:1.

The following items were identified as areas where immediate safety improvements should be made:

Note: Run the road with a ball bank indicator and add "Advisory Speed" plates as needed. Conduct inspection of signing for reflectivity, lateral offset, and mounting height. Upgrade accordingly. Check sign post spacing on 3-post break away signs.

Add 8-inch edgeline to full length of roadway.

- MP 28.74 RT. Install "Type II Object Marker" on pipe.
- MP 28.79 .82 RT. & Lt. Remove trees in clear zone.
- MP 28.9 Rt. Fill shoulder to eliminate drop off.
- MP 29.0 Rt. Vehicle pull out has wash out at edge of asphalt.
- MP 29.04 Rt. Fill in edge drop off.
- MP 29.20 Rt. (SD 87 South) Move all D&D boards back from intersection to open up sight distance (increase lateral offset).
- MP 29.31 Rt. Remove tree.
- MP 29.45 Rt. Install "Type II Object Marker" on drop off.
- MP 29.48 RT. Pave pullout to repair erosion.
- MP 29.5 -.51 Rt. Remove 2 trees.
- MP 29.59 Rt. Connect pavement on shoulder short distance between 2 asphalt sections.
- MP 29.69 Lt. Remove trees.
- MP 29.7 Rt. Remove trees.
- MP 29.78 Lt. & Rt. Install "Type II Object Marker" on pipe. Also remove tree on Lt.
- MP 29.8 Lt. Remove tree (oak).
- MP 29.88 Lt. Remove tree.
- MP 29.98 Lt. & Rt. Install "Type II Object Marker" on pipe.
- MP 30.00 Check for need for "Advanced Cross Walk" signing for eastbound traffic.
- MP 30.2 Lt. Remove tree.
- MP 30.25 Lt. Remove trees. Rt. clean out small trees.

- MP 30.3 Lt. Clear out stumps.
- MP 30.37 .50 Rt. Fill drop off next to asphalt.
- MP 30.64 Review signing at JCT. Can we combine signs so there are not 3 installations?
- MP 30.7 -.8 Lt. Remove old stumps and clean up backslope
- MP 30.8 Rt. Repair erosion along ashpalt.
- MP 30.97 Lt. & Rt. Install "Type II Object Marker" on pipe
- MP 30.97 Rt. Remove 3 trees.
- MP 31.06 Lt. Remove trees.
- MP 31.14 Lt. & Rt. Install "Type II Object Marker" on pipe.
- MP 31.25 Lt. Remove tree.
- MP 31.4 Lt. Install "Type II Object Marker" on pipe.
- MP 31.5 Rt. Remove tree.
- MP 31 .54 Lt. Remove tree.
- MP 31.55 Rt. Fill drop off along asphalt.
- MP 31.63 65 Rt. Remove trees
- MP 31.66 Lt. & Rt. Install "Type II Object Marker" marker on pipe.
- MP 31.68 Lt. Pave vehicle pull out.
- MP 31.91 Rt. Fill washed out area along asphalt.
- MP 32.13 .16 Rt. Fill drop off.
- MP 32.27 Rt. Remove tree.
- MP 32.38 Rt. Fill washed out area along asphalt.
- MP 32.45 Lt. Relocate mail boxes and install proper breakaway post for "Stop" sign.
- MP 32.66 .68 Lt. Remove trees.
- MP 33.1 .2 Rt. Remove trees.
- MP 33.26 Lt. Install "Type II Object Marker" on pipe
- MP 33.30 Rt. Remove several trees.
- MP 33.48 .53 Rt. Remove trees.
- MP 33.62 Rt. Remove tree.
- MP 34.67 .90 Rt. Remove some trees that are next to edge line leave trees that are on steep inslope.
- MP 34.72 Lt. Remove rocks.
- MP 35.18 Rt. Remove trees.
- MP 35.31 Rt. Remove trees.
- MP 35.41 Lt. Remove Rock.
- MP 35.23 .54 Rt. Remove trees
- MP 35.46 Rt. Remove rock embedded in shoulder.
- MP 35.97 Lt. Remove tree.
- MP 36.17 Lt. Install "Type II Object Marker" on box culvert.
- MP 36.31 Rt. Remove tree.
- MP 36.56 Rt. Remove rock.
- MP 36.61 Rt. Remove tree.
- MP 36.62 Lt. Remove tree.
- MP 36.74 Lt. Remove trees

- MP 36.80 Rt. & Lt. Remove several trees.
- MP 37.07 -.14 Lt. Remove trees.
- MP 37.28 Rt. Fill shoulder next to asphalt.
- MP 38.1 Lt. Lay back backslope.

The following items were identified as areas where low cost improvements could have a positive impact on safety and should be considered in a reasonable period of time:

- MP 28.37 .42 Rt. Repair wash out in ditch.
- MP 30.3 Lt. Lay back backslope.

The following items were identified as high cost improvements that should be considered as funds become available for a major rehabilitation or reconstruction of the roadway:

- MP 28.06 Rt. Remove rock.
- MP 30.97 Lt. Lay back backslope and create drainage ditch.
- MP 32.86 Lt. Flatten inslope may need to move stream
- MP 33.44 Rt. Figure cost for options of installation of guardrail or extend approach pipe to allow flattening of inslope.
- MP 33. 48 Rt. Inslope flattening.
- MP 33.77 .82 Lt. Flatten inslope may need to move stream bed.
- MP 34.18 .22 Lt. Add guard rail on outside of curve next to stream.
- MP 34.41 .48 Lt. Add guard rail or move roadway to right and flatten left inslope.
- MP 34.67 .90 Rt. Relocate stream to allow flattening of inslope, or install guardrail –
 prefer relocation of stream to allow flattening of inslope, but this may have
 environmental constraints.
- MP 34.85 Lt. Remove rock out crop.
- MP 35.1 .13 Rt. Relocate stream to allow flattening of inslope, or install guardrail –
 prefer relocation of stream to allow flattening of inslope, but this may have
 environmental constraints.
- MP 35. 23 .29 Rt. Relocate stream to allow flattening of inslope, or install guardrail –
 prefer relocation of stream to allow flattening of inslope, but this may have
 environmental constraints.
- MP 35.2 .42 Lt. Flatten slope use dirt from right side.
- MP 35.45 .53 Rt. Relocate stream to allow flattening of inslope, or install guardrail –
 prefer relocation of stream to allow flattening of inslope, but this may have
 environmental constraints.
- MP 35.45 .54 Lt. Flatten backslope use the material to reshape slope on the right.
- MP 37.2 Lt. Flatten inslope use the material from the backslope on the right side.
- Existing guardrail ends are not to current standards.
- Add shoulders to roadway full length of section

US 16A thru Iron Mounain Road (MP 39 – 55.7) SD 36 to SD 244.

The functional class of this road is Rural Minor Arterial. The road has a posted speed limit of 35 MPH and is surfaced with asphalt concrete. For the purpose of the audit the location information is referenced from the south end of the section (MP 39.04) increasing by miles heading north.

The following are the finding and recommendations of the RSAR team:

NOTE: The design criteria used to determine minimum design standards for lane width, shoulder width, clear zone, and inslope are 3R standards from SDDOT Policy RD-1998-02. They are as follows: lane width 10 ft., shoulder width 2 ft, clear zone 10 ft., & inslope 3:1. (The team thought that if we could get the trees cleared out that were within 5 feet of the roadway it would be a great improvement).

The following items were identified as areas where immediate safety improvements should be made:

- Add "Speed Limit" signs at beginning of route each end.
- Pipe ends need marking check entire route.
- Run the road with a ball bank indicator and add "Advisory Speed" plates as needed. Conduct inspection of signing for reflectivity, lateral offset, and mounting height. Upgrade accordingly.
- MP 40.28 RT. Check drop off on inside of curve this is a problem on number of curves in the first mile +. May need longer pipe.
- MP 40.59 Rt. Fill drop off.
- MP 45.9 Rt. Large rock next to edgeline.
- MP 47.5 +or- Rt. 25 MPH speed limit sign on Rt. what is the purpose of this sign? Is it to slow traffic down for the hill? Recommend removing "Speed Limit 25" sign and adding a "Hill" warning sign. There are curves north of the 25 speed limit signs that have 30 MPH advisory speed plates. These 30 MPH advisory speed plates would not be needed if this actually is a 25 MPH speed zone.
- MP 48.60 49.00 Rt. Large rock (Intermediate problem) on Rt. and trees close to roadway remove.
- MP 49.40 Rt. Remove tree
- MP 49.95 Rt. Remove tree
- MP 50.14 Rt. Remove tree
- MP 50.4 Lt. "Falling Rock" and "Low Tunnel" signs are spaced too close together.
- MP 51.4 Lt. "U" sign and "Pedestrian" sign are located side by side increase spacing between signs.
- MP 52.3 Rt. Divided highway sign -wrong sign for application. Need to sign for going from divided section to head-to-head traffic.
- MP 52.55 Rt. Remove tree and rock.

- MP 52.67 Lt. Remove 2 trees.
- MP 53.6 Rt. Remove "Low Clearance" plaque from below "Tunnel" sign. "Tunnel" has dimensions on it so "Low Clearance" should not be needed.
- MP 54.74 Lt. Remove "Road Closed" signs from road cutting across curve if it is to be closed, use a barricade if intent is not to be closed, use no signs.

The following items were identified as areas where low cost improvements could have a positive impact on safety and should be considered in a reasonable period of time:

• MP 53.02 – Curve could be widened on the outside edge of the curve.

The following items were identified as high cost improvements that should be considered as funds become available for a major rehabilitation or reconstruction of the roadway:

• Drop off sections – fill inslope.

GENERAL NOTES FOR ALL ROUTES:

- There are a number of stumps in the clear zone that should be removed.
- CUSTER STATE PARK has a restriction on tree removal along the roadway through Custer State Park. The DOT would have to work with the park service to determine how many trees could be removed.
- A discussion was held during the inspection on how we would go about reconstructing these roads. The concerns were about cost, environmental issues, disturbing the surrounding landscape and maintaining roadway safety. The team thought that careful consideration would have to be given to the design criteria in order to keep costs down, meet environmental standards, limit disturbing the surrounding landscape and provide a comfortable safety level. This may mean looking at each road individually to determine what function the road is intended to serve. For example, SD 87, US16A and SD 89 would not be serving the same purpose as does US 16 and US 385. Therefore, different design standards would need to be examined for these sections of the highway system.